REMARKS

Claims 1, 2, 5-12, 27-35 and 37-40 are currently pending in the above-identified patent application. In the subject Office Action, claims 1-2 and 5-10 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Kitagaki et al. in view of Hsu et al., in view of Lee et al. and further in view of Pron et al., since the Examiner stated that Kitagaki et al. teaches an electrical heating element **1** comprising an electrically conductive yarn **5** and non-conductive yarn **6** (Fig. 2), and yarns **2** and **3** in the form of fabric, but does not teach a polyaniline yarn, whereas Hsu et al. teaches an electrically conductive polyaniline yarn (Col. 11, lines 50-63). The Examiner then concluded that it would have been obvious to one having ordinary skill in the art to modify the Kitagaki et al. invention to replace its yarn **5** with polyaniline yarn of Hsu et al. in order to make a heating apparatus with high strength and consistent conductivity by the Hsu et al. teaching (Col. 1, lines 45-54). As for means for passing a voltage or current through the heating element, the Examiner stated that one of ordinary skill in the art would have known to connect this electrical sheet to a power source in order to provide heat as common knowledge.

The Examiner continued that Kitagaki et al. in view of Hsu et al. teaches substantially the invention including a doped polyaniline having a chosen diameter cited by Hsu et al. (Col. 11, lines 50-62), but does not teach ranges of conductivity. However, the Examiner stated that Lee et al. teaches an electrically conductive polymer with conductivity in excess of 103 S/cm (Abstract), and concluded that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki et al. in view of Hsu et al. to include ranges of conductivity as taught by Lee et al. in order to improve conductivity of the heater.

The Examiner next asserted that Kitagaki et al. in view of Hsu et al. and Lee et al. does not teach a deterioration of conductivity of polyaniline at certain temperatures, but that Pron et al. teaches variations of reduced conductivity of polyaniline at different temperatures (Page 6, paragraphs [100] and [101]), and concluded that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki in view of Hsu et al. and Lee et al. as taught by

Pron et al. in order to maintain conductivity of the heating apparatus when conductivity of the conductive polyaniline is reduced.

Applicants respectfully disagree with the Examiner regarding this ground of rejection. First, the Examiner has stated that Kitagaki et al. does not teach a polyaniline yarn. In Col. 11, lines 37-43 of Hsu et al. it is stated that: "This example illustrates spinnability of and properties of fibers derived from an insitu ring-sulfonated polyaniline/PPD-T solution in concentrated sulfuric acid (100.1%) containing 18.6% polymer mixture of insitu ring-sulfonated polyaniline and PPD-T in a weight ratio of 10/90. In this example, the polyaniline was added together with PPD-T to concentrated sulfuric acid (100.1%)." In line 62 of this column it is stated that: "The fiber conductivity is 0.0038 S/cm." TABLE 1 of Hsu et al. recites the highest conductivity of the resulting composite blend fibers to be 1.8 S/cm. Column 2, lines 12-16, of Hsu et al. states that ring-sulfonated polyaniline amounts in poly(p-phenylene terephthalamide) range from 3-40 weight percent. Applicants therefore believe that Hsu et al. clearly teaches away from the present claimed invention in that the conductivity of the "polyaniline" fiber of Hsu et al. is insignificant relative the 100 S/cm conductivity claimed in independent claims 1 and 27, and since the "polyaniline" fiber of Hsu et al. merely represents a polyaniline dopant in a principally poly(p-phenylene terephthalamide) fiber; that is, ring-substituted polyaniline blended together with large quantities of poly(p-phenylene terephthalamide) to produce a composite fiber blend having a much lower conductivity than the minimum conductivity required in subject claims 1 and 27. Thus, applicants respectfully believe that the Examiner has improperly combined Hsu et al. with Kitagaki et al., Lee et al. and Pron et al.

In paragraphs [0022] and [0023] of Lee et al. it is stated that: "It is a principal object of the present invention to provide a soluble self-orienting material as an additive for enhancing electrical conductivity of conductive polymer. Another object of the present invention is to provide a conductive polymer having an electrical conductivity of 10^3 S/cm that is more 100 times than that of a doped pure conductive polymer." However, as stated in paragraph [0044] of Lee et al.: "A soluble self-orienting material of whole aromatic polymer form, as an additive for

enhancing electrical conductivity of the conductive polymer, which comprises 1 ~ 95 percent by weight based on the total composition ... .", and in paragraph [0048] it is stated that: "The additives for conductive polymer, with above objects, of the present invention contain monomer induced with flexible side chains having various polarity or hydrophilic dibasic acid to aromatic ring, complex linked by hydrogen bond or metal coordinate bond among the monomer, or whole aromatic polyamide or polyester linked repeatedly with –NRCO-, -NROSO- (R is side chain including hydrogen), and –CO-. Monomer, complex, polyamide or polyester linked to aromatic ring above respectively." In paragraph [0069] it is stated: "Electrically conductive polymer according to the present invention suitable for enhancing contains polyaniline ... even without other dopants, on inducing SOM of the present invention, we can increase electrical conductivity of the conductive polymer by inducing chain form of dopant and of the conductive polymer linearly. ... ."

Thus, Hsu et al. teaches that ring-substituted polyaniline rendered electrically conductive by sulfonic acid is added to poly(p-phenylene terephthalamide) to make electrically conductive composite blend fibers, while Lee et al. teaches the addition of a self-orienting material to polyaniline, as an example, to render the resulting polymer conductive. Therefore, there would be no motivation for one having skill in the art to combine Hsu et al. with Lee et al. as has been suggested by the Examiner. Moreover, nowhere is it shown in these references that a combination of the technologies thereof would result in a composition having the properties relied upon by the Examiner. Applicants respectfully believe that the Examiner has improperly combined Hsu et al. with Lee et al.

The Abstract of Pron et al. teaches that" "... the use of sulphonic, phosphonic and phosphoric acids functionalized with plasticizing groups as dopants for conductive polyaniline films ... ." Pron et al. in paragraph [0101] further teaches metallic behavior of conductivity for doped polyaniline films. In particular, Pron et al. states: "For the PANI-CSA test, the conductivity maximum lies at a temperature of 285 K, whereas, for the PANI-DEHESSA test, the conductivity maximum lies at a temperature of 250 K. Beyond these temperatures, the electrical conductivity decreases when the temperature continues to increase, which reflects a metallic

behavior." Figures 2 and 3 of Pron et al. indicate that electrical conductivity was not measured above room temperature for any compositions of matter for producing the polyaniline films of Pron et al. Thus, the Pron et al. reference is not concerned with resistive heating. There is also no mention of voltage- or current-induced, irreversible destruction of conductivity at temperatures well below the destruction temperature of a polyaniline fiber, as recited in the subject claimed invention, and as will be described in more detail hereinbelow. In the case of metal fibers, conductivity would be destroyed when the fibers actually melt or are otherwise rendered discontinuous. In the absence of a mechanical discontinuity or an actual melting of the fiber, any loss of conductivity resulting from a rise in temperature can be reversed when the temperature is lowered. Thus, applicants respectfully believe that there would be no motivation to combine Pron et al. with Kitagaki et al., Hsu et al., and Lee et al. as has been done by the Examiner to teach the irreversible destruction of fiber conductivity when a current or voltage characteristic of the fiber in question is applied thereto.

Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagaki et al. in view of Hsu et al. and Lee et al. and further in view of Barry, Jr., since the Examiner stated that Kitagaki et al. in view of Hsu et al. and Lee et al. teaches substantially the claimed invention, but does not teach redoping of polyaniline fiber, whereas Barry teaches a method of enhancing conductivity including doping and (Col. 5-8). The Examiner concluded that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki et al. in view of Hsu et al. and Lee et al. to include fiber as taught by Barry, Jr. in order to positively affect electrical and mechanical properties of the heating apparatus.

Applicants respectfully disagree with the Examiner concerning this ground of rejection. Barry, Jr. teaches a process for reducing the conductivity of polyaniline-coated fabrics by subjecting the polyaniline to temperatures between 70 °C and 200 °C. There is no teaching in Barry, Jr. that this procedure would provide any beneficial increase in conductivity for solid, doped-polyaniline fibers. Moreover, since Hsu et al. teaches away from the present claimed invention, applicants respectfully believe that the combination of Hsu et al. with Barry, Jr. is improper.

Additionally, since there is no motivation to combine Hsu et al. with Lee et al., applicants respectfully believe that the combination of Hsu et al. and Lee et al. with Barry, Jr. is improper.

Claims 12, 27-29, 31-33, 35 and 37-40 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagaki et al. in view of Hsu et al. and Lee et al. and further in view of Fukushima et al., since the Examiner stated that Kitagaki et al. in view of Hsu et al. and Lee et al. substantially teaches the claimed invention including a doped polyaniline having a chosen diameter (Col. 11, lines 50-62), but does not teach peak stress and as-spun modulus of 2.3. However, the Examiner asserted that Fukushima et al. teaches a hybrid material comprising polyaniline (Col. 19, line 63), and having a peak stress of 110 MPa, and an as-spun modulus of 2.3 (Col. 25, Table 2), and that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki et al. in view of Hsu et al. to include ranges of conductivity, peak stress and as-spun module as taught by Lee et al. and Fukushima in order to improve durability of the polyaniline heater.

Applicants respectfully disagree with the Examiner on this ground of rejection. Although Fukushima teaches a hybrid material containing an octahedral sheet comprising octahedra linked with each other to provide a sheet-like structure and a tetrahedral sheet comprising tetrahedra linked with each other to provide a sheet-like structure; and an organic portion bonded by covalent bond to an element located at the tetrahedral site of the tetrahedra constituting the layer having a tensile elastic modulus of 2.3 GPa, applicants fail to appreciate how this exotic material relates to the fibers of the present invention. Moreover, applicants respectfully believe that there would be no motivation to combine Fukushima et al. with Kitagaki et al., Hsu et al., Lee et al., and Pron et al. to teach the present claimed invention. Since Hsu et al. teaches away from the present claimed invention, applicants respectfully believe that the combination of Hsu et al. with Fukushima et al. is improper. Additionally, since there is no motivation to combine Hsu et al. with Lee et al., applicants respectfully believe that the combination of Hsu et al. and Lee et al. with Fukushima et al. is improper.

Claim 30 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagaki et al., Hsu et al., Lee et al. and Fukushima and further in view of Eiffler, since the Examiner stated that Kitagaki et al. in view of Hsu et al., Lee et al. and Fukushima discloses substantially the claimed invention, but does not disclose a range for the molecular weight, but that Eiffler discloses a polymer having a molecular weight of greater than 200,000 g/mol (Col. 9, lines 26-30). The Examiner concluded that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki et al. in view of Hsu et al., Lee et al. and Fukushima to include a molecular weight of the polymer in polyaniline fiber as taught by Eiffler as a generally used average weight of the polyaniline fiber in order to improve durability of the conductive fiber.

Applicants respectfully disagree with the Examiner concerning this ground of rejection. In Col. 20, lines 58-63 of Eiffler, it is stated that: "The produced polypyrrole based powder composition have electrical conductivities of up to 5 S/cm. Surprisingly, it has been found that polyaniline based powder compositions having electrical conductivities of even up to 50 S/cm are obtained according to this batch process." Therefore, applicants believe that there would be no motivation to combine Eiffler with any of Kitagaki et al., Hsu et al., Lee et al., or Fukushima et al., since the requisite claimed conductivity of greater than 100 S/cm could not be obtained even using high molecular weight polyaniline. Eiffler also teaches away from the present claimed invention, making the combination of Eiffler with other references, as the Examiner has done, improper. Moreover, since Hsu et al. teaches away from the present claimed invention, applicants respectfully believe that the combination of Hsu et al. with Eiffler is improper. Additionally, since there is no motivation to combine Hsu et al. with Lee et al., applicants respectfully believe that the combination of Hsu et al. and Lee et al. with Eiffler is improper. Further, since there is no motivation to combine Fukushima et al. with Kitagaki et al., Hsu et al. and Lee et al., applicants respectfully believe that the combination of Kitagaki et al., Hsu et al., Lee et al. and Fukushima et al. with Eiffler is improper.

Claim 34 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagaki et al. in view of Hsu et al., Lee et al. and Fukushima and further in view of

Barry Jr., since the Examiner asserted that Kitagaki et al. in view of Hsu et al., Lee et al. and Fukushima teaches substantially the claimed invention, but does not teach redoping of polyaniline fiber, whereas Barry, Jr. teaches a method of enhancing polyaniline conductivity including doping and redoping (Col. 5-8), and that it would have been obvious to one having ordinary skill in the art to modify the invention of Kitagaki et al. in view of Hsu et al., Lee et al. and Fukushima to include redoping of polyaniline fiber as taught by Barry, Jr. in order to positively effect electrical and mechanical properties of the heating apparatus.

Applicants respectfully disagree with the Examiner concerning this ground of rejection. Since Hsu et al. teaches away from the present claimed invention, applicants respectfully believe that the combination of Hsu et al. with Barry, Jr. is improper. Additionally, since there is no motivation to combine Hsu et al. with Lee et al., applicants respectfully believe that the combination of Hsu et al. and Lee et al. with Barry, Jr. is improper. Further, since there is no motivation to combine Fukushima et al. with Kitagaki et al., Hsu et al. and Lee et al., applicants respectfully believe that the combination of Kitagaki et al., Hsu et al., Lee et al. and Fukushima et al. with Barry, Jr. is improper.

In the Response to Arguments section of the subject Office Action, the Examiner stated: "As to means for passing a voltage or current through the heating element, one of ordinary skill in the art would have known to connect the electrical sheet to a power source in order to provide heat. By the way, Applicant has not provided any specific details for these means in his application, only a general description of available power sources. As for relevance of the references, applicant admits that Lee teaches a conductive polymer having an electrical conductivity of more than 100 S/m, thus admitting that the Lee reference is valid and therefore is properly applied with other references in the Office Action."

Applicants respectfully disagree with the Examiner on both of the latter assertions, since on page 10, lines 14-19 of the subject Specification, as originally filed, it is stated that "Power sources include both ac and dc electrical sources. Such sources comprise batteries, and electrical power supplies and further include electrical constant current and/or constant voltage power supplies." If, as the

Examiner asserts above: "As to means for passing a voltage or current through the heating element, one of ordinary skill in the art would have known to connect the electrical sheet to a power source in order to provide heat.", then applicants respectfully believe that the description of power sources provided by applicants should be sufficient.

Applicants fail to understand and do not agree with the Examiner's assertion that: "As for relevance of the references, applicant admits that Lee teaches a conductive polymer having an electrical conductivity of more than 100 S/m, thus admitting that the Lee reference is valid and therefore is properly applied with other references in the Office Action."

For the reasons set forth hereinabove, applicants respectfully believe that the Examiner has improperly combined references, some of which clearly teach away from the present claimed invention (e.g., Hsu et al. and Eiffler), and some for which there would be no motivation to combine (e.g., Lee et al. and Fukushima et al.). The Examiner has therefore failed to make a *prima facie* showing of obviousness which is required in a rejection under 35 U.S.C 103(a).

The present claimed invention teaches self-fusing properties of conductive doped polyaniline fibers and fabrics fabricated therefrom. As set forth in subject claims 1 and 27: "... said conductive polyaniline fiber comprises at least one dopant such that said conductive polyaniline fiber is characterized by as as-spun conductivity of ≥ 100 S/cm, said conductive polyaniline fiber having a chosen diameter, and wherein the conductivity of said conductive polyaniline fiber is substantially destroyed at temperatures lower than the temperatures at which said conductive polyaniline fiber loses said at least one dopant, or the temperature at which said at least one dopant decomposes, when a voltage or current greater than a voltage or current characteristic of the conductive polyaniline fiber is applied thereto by said means for passing a voltage or a current through said heating element; ... ." This previously unknown phenomenon is more fully described on page 19, beginning on line 11, to line 5 of page 20 of the subject Specification, as originally filed. To be noted is that while the temperature at which irreversible destruction of fiber conductivity for AMPSA-doped polyaniline fiber is approximately

321 K (48 °C), the thermal decomposition temperature for such polyaniline fiber is about 453 K (180 °C), and the backbone of polyaniline fibers commences decomposition at greater than 593 K (320 °C).

Nowhere in any of the references cited by the Examiner nor the combinations thereof asserted by the Examiner is this particular claimed innovation taught or described.

For these reasons, applicants believe that claims 1, 2, 5-12, 2-35, and 37-40, are in condition for allowance or appeal, the former action by the Examiner being earnestly solicited. Reexamination and reconsideration are respectfully requested.

Respectfully submitted,

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